understanding of the life-history and habits of the species. Even then there may be danger, as with a new environment habits frequently change in a marked degree.

Accidental Introductions.

The agency of man, however, has been more potent in extending the range of species and in changing the character of the faunas and floras of the regions which he inhabits by means of accidental importations.

The era of accidental importations began with the beginning of commerce, and has grown with the growth of commerce. The vast extensions of international trade of recent years, every improvement in rapidity of travel and in safety of carriage of goods of all kinds, have increased the opportunities of accidental introductions, until at the present time there is hardly a civilised country which has not, firmly established and flourishing within its territory, hundreds of species of animals and plants of foreign origin, the time and means of introduction of many of which cannot be exactly traced, while of others even the original home cannot be ascertained, so widespread has their distribution become.

These accidental importations would at first glance seem to have been more abundant with plants than with animals, since the opportunities for the carriage of seed, especially flying or burr-like seed, and especially when we consider the vitality of this form of the plant organism, are plainly manifold, but possibly even this obvious generalisation must be modified in view of the multitudinous chances for free travel, which the smaller insects have under our modern systems of transportation.

The agencies which have mainly been instrumental in the accidental distribution of plants are:

(1) Wind storms. It is obvious that light-flying seeds may be carried many hundreds of miles by hurricanes, and may fall in new regions.

(2) Water. This is a very important agency in the distribution of plants upon the same continent, but less important as affecting intra-continental distribution. Still, they may be carried by this means from one island to another adjoining island, and when lodged in the crevices of the driftwood they undoubtedly travel greater distances.

(3) Birds. Seeds are frequently carried great distances by birds. Many of the larger seeds will germinate after passing through the alimentary canal of a bird, and may thus be eaten at one point and voided with the excrement at a widely distant point. It has been shown, for example, that the local distribution of *Rhus toxicodendron* is greatly affected by the carriage and distribution of the seed in this way by the common crow. Smaller seeds are carried in earth on the feet of birds. Darwin's example of a wounded red-legged partridge which had adhering to its leg a ball of earth weighing $6\frac{1}{2}$ ounces, from which he raised thirty-two plants of about five distinct species, is an evidence of the possibilities of this agency, while his experiment with $6\frac{3}{4}$ ounces of mud from the edge of a pond which produced 537 distinct plants, an average of a seed for every six grains of mud, is still more conclusive.

(4) Ballast. This is the first of the distribution methods which may be combined under the head of "agency of man." The discharge of earth ballast by vessels coming from abroad has been a notable means of distribution of plants by seed. We have just seen how many seeds may germinate from a very small lump of earth, and the possibilities in this direction of the many thousands of pounds of discharged ballast are very great. In fact, the ballast grounds in the neighbourhood of great cities are invariably favourite botanical collecting spots; they have usually a distinctive flora of their own, and from these centres many introduced plants spread into the surrounding country.

(5) Impure seed. The great industry in the sale of seed which has grown up of late years is responsible for the spread of many plant species, principally, it must be said, undesirable species. Mr. L. H. Dewey says: "It may be safely asserted that more of our foreign weeds have come to us through impure field and garden seeds than by all other means combined."

(6) The packing material of merchandise. The hay or straw used in packing crockery, glassware, or other fragile merchandise, is a frequent carrier of foreign seeds. Such goods frequently reach the retailer without repacking, and the hay or straw is thrown out upon the fields, or used as bedding for domestic animals and carried out with the manure.

(7) Nursery stock. Plants are often accidentally introduced by means of seeds, bulbs and root stocks attached to nursery stock, or among the pellets of earth about the roots of nursery stock. The extraordinary development, of late years, of commerce in nursery stock has undoubtedly been responsible for the intra-continental carriage of many species of plants in this way.

Instances of the accidental spread of larger animals by man's agency are necessarily wanting. Of the smaller mammals the house rat and the house mouse have been accidentally carried in vessels to all parts of the world, and have escaped and established themselves, the former practically everywhere except in boreal regions, or only in its southern borders, and the latter even as far north as the Pribyloff Islands, as I am informed by Dr. Merriam. Small reptiles and batrachians are often accidentally carried by commerce from one country to another; but although there are probably instances of establishment of such species, none are known to me at the time of writing.

Land shells are often transported accidentally across the ocean in any one of the many ways in which the accidental transportation of plants and insects may be brought about, and by virtue of their remarkable power of lying dormant for many months are able to survive the longest journeys. The conditions which govern the establishment of species in this group, however, seem somewhat restricted, whence it follows that comparatively few forms have become widespread through man's agency, although Binney mentions a number of European species which have been brought by commerce into the United States and have established themselves there, mainly in the vicinity of the seaport towns of the Atlantic coast.

With the earthworms a striking situation exists. It has been shown that, "without a single exception, the Lumbricidæ from extra-European regions are identical with those of Europe; there is not a variety known which is characteristic of a foreign country." Careful consideration of the evidence seems to show that this is due to accidental transportation by the agency of man.

Comparatively little has been done in the study of the geographical distribution of insects.

The insects which are accidentally imported are carried in three main ways. Either (1) they are unnoticed or ignored passengers on or in their natural food, which is itself a subject of importation, such as nursery stock, plants, fresh or dried fruit, dried food-stuffs, cloths, lumber, or domestic animals; or (2) their food being the packing substances used to surround merchandise or the wood from which cases are made, they are thus brought over; or (3) they may be still more accidental passengers, having entered a vessel being loaded during the summer season, and hidden themselves away in some crevice. The coleopterists (Hamilton and Fauvel) make a distinction by name among these classes, calling the first group "insects of commerce," and the latter "accidental importations."

The practical point to which we must come, after summarising all that has been shown, is that since so many species have been imported by pure accident, and have succeeded perfectly in becoming acclimatised, may not much be accomplished by wisely-planned and carefully-guarded introductions? The work of Mr. Albert Koebele, first for the United States Government, afterwards for the State of California, and now for the Hawaiian Government, is certainly an indication, taken in connection with what we have shown, that thorough experimental work with predaceous and parasitic insects promises, in especial cases results of possibly very great value.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

Oxford.—The announcements of professors, readers, University teachers, and lecturers for Michaelmas term include the following:—A course of lectures on elementary pathology by the Regius Professor of Medicine, Dr. J. Burdon-Sanderson. A practical course of instruction in general pathology by the University lecturer, Dr. Ritchie. The Lichfield Lecturer in Clinical Surgery, Mr. W. L. Morgan, will lecture on elementary surgery. The Professor of Human Anatomy, Prof. A. Thomson, will lecture on human osteology. The Lecturer in Materia Medica, Mr. J. E. Marsh, will give at the University Museum a practical course of organic chemistry. The Savilian Professor of Geometry, Prof. W. Esson, will lecture at Merton College on (1) the theory of plane curves; (2) synthetic geometry. The Savilian Professor of Astronomy, Prof. H. H. Turner, will lecture at the University Observatory on elementary mathematical astronomy. Mr. H. H. Champion will conclude his lectures on lunar theory. The Sedleian Professor of Natural Philosophy, Rev. Bartholomew Price, will lecture at Pembroke College on optics, physical and geometrical. The Waynflete Professor of Mineralogy, Prof. H. A. Miers, will lecture at the University Museum on elementary crystallography. The Waynflete Professor of Pure Mathematics, Prof. E. B. Elliott, on the theory of numbers. The Linacre Professor of Comparative Anatomy, Prof. E. Ray Lankester, on the Mollusca. Dr. W. B. Benham, on the flat worms; Mr. G. C. Bourne, on Von Baer's Law; and Mr. J. B. Thompson, on the morphology of the Ichthyopsida. The Professor of Experimental Philosophy, Prof. R. B. Clifton, on experimental physics. The Clarendon Laboratory will be open daily, from 11 a.m. to 4 p.m., for instruction in practical physics, under the superintendence of Prof. Clifton, Mr. Walker, Mr. Alsop, and Mr. Hudson. The Lecturer in Mechanics, Rev. F. J. Jervis-Smith, on elementary mechanics and the structure of simple machines. The Waynflete Professor of Chemistry, Prof. W. Odling, on elementary organic chemistry. The Aldrichian Demonstrator, Mr. W. W. Fisher, on inorganic chemistry; Mr. J. Watts, on organic chemistry; Mr. V. H. Veley, on physical chemistry; Mr. J. E. Marsh, on the history of chemical theory; Mr. J. A. Gardner, on aromatic compounds, other than benzene derivatives. The laboratory is open daily for instruction in practical chemistry from 10 a.m. to 4 p.m. The Waynflete Professor of Physiology, Prof. F. Gotch, will give (1) a general course of physiology; (2) advanced course on muscle. There will also be courses in histology, practical histology, and elementary physiological chemistry. The Professor of Geology, Prof. W. J. Sollas, will lecture on stratigraphical and physical geology. The Sherardian Professor of Botany, Prof. S. H. Vines, will give at the Botanic Garden (1) an elementary course (with practical work); (2) an advanced course (with practical work). The Professor of Anthropology, Prof. E. B. Tylor, will lecture at the University Museum on the anthropology of social, moral, and religious institutions.

Dr. J. R. Magrath, Provost of Queen's College, has been re-admitted as Vice-Chancellor for the ensuing year.

Mr. H. F. Pelham, Fellow of B.N.C., and Camden Professor of Ancient History, has been elected President of Trinity College in place of the Rev. Dr. Woods, resigned.

The following elections to Natural Science Scholarships and Exhibitions were made during the Long Vacation:—Merton College—to a Scholarship, Mr. F. W. Charlton, of Rugby School; to an Exhibition, Mr. E. L. Edlin, of Wyggeston Boys' School, Leicester. New College—to a Scholarship, Mr. E. H. J. Schuster, of the Charterhouse. Corpus Christi College —to a Scholarship, Mr. R. Stansfield, of Manchester Grammar School. Non-Collegiate Students—to a Shute Scholarship, Mr. C. H. Barber, of Wyggeston Boys' School, Leicester.

Mr. A. F. Walden (Magdalen College) has been appointed Lecturer in Natural Science at New College.

Mr. J. A. Gardner (Magdalen) has abandoned his work in Oxford for a post as Consulting Analytical Chemist in London.

Prof. W. J. Sollas delivered his inaugural lecture on Tuesday last. The lecture, which was of great interest, dealt principally with the part played by Oxford in the history of geology.

Cambridge.—The election of a Professor of Pathology, in the place of the late Prof. Roy, will take place on Saturday, November 6. The electors are Dr. Bradbury, Dr. Gaskell, Dr. Foster, Dr. Payne, Dr. Allbutt, Sir James Paget, Dr. D. MacAlister, and Dr. Latham.

Mr. J. Graham Kerr, of Christ's College, has been appointed Demonstrator of Animal Morphology in the place of Prof. E. W. Macbride, now of Montreal.

The University Lecturer in Geography announces two courses of lectures for this term. One on the geography of Europe will be suitable for history students; the other will be on physical geography.

The late Sir J. C. Bucknill, F.R.S., has by his will left one-third of the residue of his estate, after paying certain legacies, to the president and treasurer of University College, London, for the purpose of founding a medical scholarship, to be called the Bucknill Scholarship, and to be awarded at least once in three years.

At a meeting of the West Riding County Council, on Wednesday in last week, the Marquis of Ripon, in moving that a grant of 400*l.* be made to the Yorkshire College, stated that the debt on the institution, which a year ago amounted to 34,000*l.*, had been reduced to 28,000*l.*, and expressed a hope, not only that the whole of the remaining debt would soon be liquidated, but also that a permanent endowment would be secured. The motion was unanimously adopted.

Dr. Hans Reusch, director of the geological survey of Norway, has been appointed for the session 1897–98 to the Sturgis-Hooper professorship of geology in Harvard University, left vacant since the death of Prof. J. D. Whitney a year ago. Prof. Reusch will lecture on Vulcanism during the first half-year, treating volcanoes and eruptive rocks in general, earthquakes, and movements of the earth's crust. In the second half-year he will lecture on the geology of Northern Europe, and its relations to general geology.

A course of twenty-five lectures on coal-tar distillation will be given, on Wednesday evenings, at the Goldsmiths' Institute, New Cross, by Mr. W. J. Pope, commencing on October 27. Special attention will be paid to methods of analyses, and to the plant used both in this country and abroad. The course will be fully illustrated with the aid of experiments and the optical lantern. Lectures of this kind, in which the subject is treated scientifically, do more to advance technical education than many courses of instruction in which manufacturing devices are described while the principles underlying them are left out of consideration.

The following recent gifts to educational institutions in the United States are announced in *Science*:—Harvard College and the Massachusetts Institute of Technology will each receive about 750,000 dollars from the estate of the late Mr. Henry M. Pierce, under whose will they are, together with three other institutions, the residuary legatees.—The will of the late Eliza W. S. P. Field gives 80,000 dollars to the University of Pennsylvania, and makes the University residuary legatee of her estate.—Mrs. Esther B. Steele, of Elmira, N.Y., has given 5000 dollars towards the cost of a physical laboratory for Syracuse University. The building, which will cost about 25,000 dollars, will be erected shortly.—Furman University, at Greenville, S.C., has been given by Dr. and Mrs. F. A. Miles real estate valued at 20,000 dollars.—The will of the late Mr. Theodore Lyman bequeaths 10,000 dollars to Harvard University, and a collection of valuable books to the Museum of Comparative Zoology.—Ex-Governor Flower has given 5000 dollars to Cornell University for the purpose of a library for the Veterinary College.—By the will of the late Dr. Antoine Ruppaner the Harvard Medical School will receive 10,000 dollars, to be called the Dr. Ruppaner Fund.—Mr. H. H. Hunnewell has given 5000 dollars towards the endowment of the Surgical Laboratory of the Harvard Medical School.

The Michigan College of Mines is the only technical school in the United States in which a full and elective system is adopted for its engineering instruction. The only subjects which are compulsory for all students are the principles of geology and the principles of mining; beyond these the student is allowed unrestricted freedom of choice in his studies, provided only that he shows that his preparatory knowledge is sufficient to enable him to take advantage of the instruction given. The following extract from the prospectus of the College for 1897–98 should be known to the managing committees of those of our technical schools and colleges which aim at filling students with heterogeneous knowledge, while leaving the intellectual and reasoning faculties undeveloped:—"If students are to achieve success here, it is imperative that they be able to collate facts, reduce them to order, draw sound conclusions from them, and use with facility the knowledge thus gained. All subjects of study, whether taught here or required for entrance, are regarded by the College as merely so many tools which the student, in proportion to the excellence of his training, can use to advantage in shaping his future. The necessity for a daily drill in reasoning out fully, and applying through varied methods, the fundamental principles of each subject of study cannot be too strongly impressed upon teachers; without it no educational results of sterling value can be obtained."

At King's College, London, in conjunction with the Technical Education Board of the London County Council, advanced evening science classes are now being held on Civil Engineering, by Prof. Robinson, on Mondays, from 7 to 9; Mechanical Engineering, by Prof. Capper, on Tuesdays, from 7 to 9; Architecture, by Prof. Banister Fletcher, on Wednesdays, from

7 to 9; Natural Philosophy, under the direction of Prof. W. Grylls Adams, F.R.S., on Wednesdays, from 6 to 8.30; and on Pure Mathematics, by Prof. Hudson, on Thursdays, from 6 to 8 These courses are designed for students who have, by attendance at other classes, already reached an advanced stage in their technical work. Intending students should communicate by letter with the professors, taking the class they propose to attend, and giving particulars of their previous training. The courses of instruction afford an opportunity to students who can study only in the evenings to obtain instruction in well-equipped University laboratories, and make available to evening students the same advantages as are enjoyed by University day students, but they are only intended for those who are practically engaged during the day in some trade, business, or occupation. There are also held at King's College, the following free Saturday morning classes for teachers:—(1) Physics, on Saturday morning from 10 to 1, under the general superintendence of Prof. W. G. Adams, F.R.S. (2) Mathematics, by Prof. Hudson, on the teaching of elementary mathematics, on alternate Saturdays, at 10 a.m. (3) Strength of Materials (Saturdays, 10 a.m.), by Prof. Capper. (4) Principles of Practical Physiology (Saturdays, 11 a.m.), by Prof. Halliburton, F.R.S. The Saturday morning classes, we understand, are full, but there are still vacancies at some of the evening classes.

The encouragement given to higher scientific instruction by the London Technical Education Board is shown in the latest number of the Board's *Gazette*, which contains a list of the principal public institutions of London at which instruction adapted to the requirements of the London University examinations above the matriculation will be given during the session just commencing. In the case of most of the institutions referred to in the list, evening as well as day classes are held in pure and mixed mathematics, experimental physics, chemistry, botany, zoology, biology, physiology, and geology. No institutions are included in the list except institutions of recognised university rank and polytechnics. Another list in the *Gazette* shows the principal evening classes in science, art and technology, to be held in London during the session 1897–98. The most noteworthy addition since last year to the supply of technical instruction is the scheme of instruction provided by the Northampton Institute in Clerkenwell. This institution has drawn up a very comprehensive series of courses especially adapted to the workers in the building and engineering trades and in artistic crafts, such as watchmakers, jewellers, goldsmiths, silversmiths and electrotypers. It is interesting to notice that this institution offers for the first time, together with the Regent Street Polytechnic, special instruction in cycle making. The electrochemical department is one that should be capable of considerable development in the future. The Northern Polytechnic also enters on its first full session. Admirable provision is made in this institution for the study of chemistry and physics, and the polytechnic is also provided with good carpentering and engineering workshops. The Borough Polytechnic is erecting new buildings for giving additional accommodation to classes in printing, bookbinding, boot and shoe making, carpentry, and wheelwrights' work. A model bakery is also in process of erection. The Battersea Polytechnic is providing additional accommodation for the teaching of chemistry and biology. The Bolt Court Guild and Technical School offers instruction in various branches in lithography and photo-process work. The classes at St. Thomas' Charterhouse School have been to some extent remodelled and placed on a new basis, and considerable additions have been made to the laboratory accommodation. The classes are being organised into a definite institution under the name of the St. Thomas' Charterhouse and Rogers' Institute.

SCIENTIFIC SERIALS.

Meteorologische Zeitschrift, September.—Investigations respecting wind velocity, by Prof. G. Hellmann. Our knowledge of wind direction over the globe is fairly satisfactory, but as regards the velocity it is defective, owing to the paucity of good anemometrical observations until within a few years. These observations are also affected by several causes, such as differences of height above ground, the exposure of the instrument, methods of reduction, and instrumental errors. The author has deduced the yearly period of wind velocity for all stations for which he could find a series of ten years' observations, for all parts of the world. The paper is accompanied by tables and diagrams, showing the mean velocity in metres per second for each month and for the year, and contains a valuable discussion of the results. The general conclusions are: (1) That the velocity increases with latitude, and decreases from the coast inland. (2) In the yearly period, the maximum in higher latitudes and exposed coasts occurs during the cold season, while in the interior of the continents it occurs between March and July. (3) The period of maximum velocity generally corresponds with that of the stormy season. (4) The minimum velocity generally occurs in August or September at those inland stations which have a spring maximum, while at coast stations which have a winter maximum, the minimum takes place in June or July. (5) The amplitude of the yearly period is greater on the coast than inland, but greatest in districts subject to strong periodical winds and monsoons.—Meteorology and terrestrial magnetism in Finland, by A. Heinrichs and E. Biese. The paper contains a summary of the meteorological observations made during the last 150 years, and which furnish good materials for investigations into secular changes of climate. The magnetic observations date from 1780. The organisation and discussion of these valuable observations during the last half of the last century and the first part of this, were principally due to the encouragement given by the University of Åbo.

The *Journal of Botany* for October reports a very remarkable addition to the British flora, in *Stachys alpina*, found by Dr. C. Bircknall in Gloucestershire, apparently wild. Mr. G. Murray gives an interesting account of his observations on the minute free-floating vegetation of the west coast of Scotland, carried on at the request of the Fishery Board of Scotland, with a description of the method used for the capture of the minute organisms.

SOCIETIES AND ACADEMIES.

London.

Entomological Society, October 6.—The Rev. Canon Fowler, Vice-President, in the chair.—Mr. W. H. Bennett aud Mr. B. Tomlin were elected Fellows of the Society.—Mr. Merrifield exhibited specimens of *Aporia cratægi* and *Argynnis paphia*, subjected to high and low temperatures during the pupal stage. In both species the examples which had been cooled were much darkened. Mr. Tutt showed for comparison the extremes of over 500 examples of *A. cratægi* bred or captured in Kent between 1860 and 1868, but none were so marked as those which had been artificially treated.—Mr. Tutt showed a remarkable melanic aberration of *Nemeophila plantaginis*, in which all trace of the pale ground colour of the hind wings was lost; also a series of *Abraxas ulmata* captured during the past summer by Mr. Dutton in the neighbourhood of York. Previously aberrations of the species had been rare, but a large number of this series were suffused with blue-grey or smoky-ochreous. Many of the aberrant forms were cripples. He also showed for Dr. Riding bred specimens of both broods of *Tephrosia bistortata* from Clevedon, Somerset, and bred specimens of *T. crepuscularia* and its ab. *delamerensis* from York. Hybrids were exhibited between *T. bistortata* (♂ and ♀) and *T. crepuscularia* (♀ and ♂), between the former and the form *delamerensis* (♀ and ♂), and between the two latter crosses. The offspring of the first crosses were roughly divisible into two groups following the parent forms, those of the second tended to become mongrel in appearance. Hybridisation led to the production of continuous broods, and certain broods tended to produce mlaes only. The colouration became more intense with increase in the duration of the pupal stage.—Dr. Dixey drew attention to the experiments on hybridisation recorded in Dr. Standfuss's "Handbuch der Paläarktischen Gross-Schmetterlingen," and gave a summary of the results.—Mr. Champion showed for the Rev. J. H. Hocking an example of the long-bodied moth *Satacoma agrionata*, from New Zealand; also one of *Protopaussus walkeri*, Waterh., from China, the subject of a later communication; and specimens of the rare *Emblethis verbasci*, F., from the Scilly Isles.—Mr. Jacoby showed a Halticid beetle with a singular abnormality, the side-margin of the prothorax being split to embrace a long process.—Dr. Chapman exhibited and described varieties of *Spilosoma lubricipeda* and *Acronycta psi* bred by Dr. Riding and himself. In the latter species the characters of the different races were